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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,824	11/21/2003	Lav Ivanovic	030928/2935P	1337

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EXAMINER

JANAKIRAMAN, NITHYA

ART UNIT	PAPER NUMBER
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2123

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/718,824	Applicant(s) IVANOVIC ET AL.	
	Examiner Nithya Janakiraman	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11/21/2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This action is in response to the application filed on November 21, 2003. Claims 1-20 are presented for examination.

Claim Objections

1. Claim 8 is objected to because of the following informalities: the phrase 'a minimum values' is grammatically incorrect. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 5-8 and 15-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. Regarding claims 5-8 and 15-18, the variable 'k_j' is given no definition in either the specification or the claim bodies, and thus lacks antecedent support.
4. Regarding claim 8, it is unclear as to whether 'minimum values' and 'maximum value' apply to each and everyone of the given parameters (thickness, n, k) or not.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by “IMD-Software for Modeling the Optical Properties of Multilayer Films”, Windt (hereinafter Windt).

6. Regarding independent claim 1 (and 10), Windt teaches:

A method (computer-readable medium) for obtaining an optimal reflectivity value for complex multilayer stacks (see page 368, column 1), comprising:

(a) generating a model of a multilayer stack and parameterizing each layer by a thickness and an index of refraction (see Introduction, ‘Reflection and transmission at an ideal interface’);

(b) allowing a user to input values for the parameters (see page 365, ‘User Interface’);

(c) calculating an extrema for a cost function of reflectivity R using the input parameter values (see Windt, page 368, column 1);

(d) calculating sensitivity values S for the extrema points (see page 360, “the relative sensitivities of the optical functions to the parameters that describe the multilayer structure”); and

(e) obtaining an optimal value by calculating a cost function $R+S$ (see page 362, column 1, "...the reflectance can be reduced equally well by either a rough interface, in which the transition between the two materials is abrupt at any point or a diffuse interface, in which the index varies smoothly along the z direction or by an interface that can be described as some combination of the two cases"; equations 4, 5(a). In this case, 'sensitivity' is equivalent to the diffuseness/roughness variable σ , which is used in the reflection coefficient modification factors $w^{\sim}(s)$).

7. Regarding claim 2 (and 12), Windt teaches:

The method (computer-readable medium) of claim 1 wherein step (e) further includes the step of:

calculating the cost function as $R+\alpha S$, where α is a weighted parameter (see page 364, "weighting factors").

8. Regarding claim 3 (and 13), Windt teaches:

The method (computer-readable medium) of claim 1 wherein step (a) further includes the step of:

providing the multilayer stack with N layers, where a top layer comprises a top ambient resist layer followed by one or more layers of materials that are patterned over a substrate layer (see page 362).

9. Regarding claim 4 (and 14), Windt teaches:

The method (computer-readable medium) of claim 2 wherein step (a) further includes the step of:

providing the index of refraction to include a real and an imaginary number (see page 361, column 1).

10. Regarding claim 5 (and 15), Windt teaches:

The method (computer-readable medium) of claim 4 wherein step (a) further includes the step of:

providing a j^{th} layer with thickness d_j , and a complex index of refraction $n_j = n_j - i k_j$ (see 'Optical functions of a multilayer stack').

11. Regarding claim 6 (and 16), Windt teaches:

The method (computer-readable medium) of claim 5 wherein step (a) further includes the step of:

providing the ambient and substrate with complex indexes of refraction: $n_0 = n_0 - i k_0$ and $n_{N+1} = n_{N+1} - i k_{N+1}$, respectively (see 'Reflection and transmission at an ideal interface').

12. Regarding claim 7 (and 17), Windt teaches:

The method (computer-readable medium) of claim 6 wherein step (a) further includes the step of:

defining reflectivity at an interface between two layers as a cost function, wherein the reflectivity R_j at a j^{th} interface (between the $(j-1)^{\text{th}}$ and j^{th} layers) is a function of $3(N-j+1)+4$ parameters, which are; n_{j-1} , $n_j \dots n_N$, n_{N+1} ; k_{j-1} , $k_j \dots k_N$, k_{N+1} ; d_j , $d_{j+1} \dots d_N$ (see Figure 3, 'Optical functions of a multilayer stack', 'Optical constants determination for a thin film').

13. Regarding claim 8 (and 17), Windt teaches:

The method (computer-readable medium) of claim 1 wherein step (b) further includes the step of:

allowing the user to enter values for the thickness and the complex indexes of refraction (n and k) for each layer, including a current starting point, a minimum values, and a maximum value (see 'User Interface', 'Summary').

14. Regarding claim 9 (and 19), Windt teach:

The method (computer-readable medium) of claim 8 wherein step (b) further includes the step of:

allowing the user to choose which of the parameters will be independent variables and to enter step values, wherein those parameters that are not designated as varying are fixed (see 'User Interface').

15. Regarding claim 10 (and 20), Windt teach:

The method (computer-readable medium) of claim 1 wherein step (e) further includes the step of: defining the sensitivity as $S = (\text{Max } R - \text{Min } R)$ for all varied parameters (see page 364, "a constraint on the range of acceptable parameter values can be specified as well", 'Confidence interval computation').

Additional References

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
17. "Optical Analysis of Complex Multilayer Structures Using Multiple Data Types": Physical sample parameters (such as film thickness, optical constants, etc.) from experimentally measured optical data and a model-based analysis procedure is use. An optical model is constructed by sequentially adding layers on top of a substrate material. Each layer is parameterized by a thickness and complex index of refraction.
18. "Optical Lithography Simulation and Photoresist Optimization for Photomask Fabrication": Lithographic simulation was utilized for process optimization because of the very high cost of mask patterning. Function determination requires knowledge of the index of refraction of both the resist and substrate. Film thickness was calculated from the measured maxima and minima in the reflectivity as a function of wavelength.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nithya Janakiraman whose telephone number is 571-270-1003. The examiner can normally be reached on Monday-Thursday, 8:00am-5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on (571)272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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